Dimock Residential Ground Water Site
Executive Summary of the Data Collection, Validation and Review Process
July 24, 2012

The objective of sampling was to determine whether any toxic substances were present in the residential drinking water wells at this site that may pose a threat to the health of persons ingesting, contacting or engaging in typical residential uses of the groundwater to the extent that an EPA Removal Action should be continued, expanded or terminated. The analytical protocols were selected based in part on contaminants that may be present due to natural gas exploration, drilling or hydraulic fracturing activities occurring in the region. Following EPA's Quality System, environmental data collected were thoroughly reviewed by both the laboratory and field team to ensure that decisions were based on data of known and documented quality. Information about EPA's Quality System can be found at the following website: http://www.epa.gov/quality/. The project sampling and analytical approach is included in the *Residential Well Sampling QA/QC Work Plan Dimock Residential Groundwater Site* Rev 01 February 29, 2012 (Sampling QA/QC Work Plan).

The sampling effort undertaken by EPA at Dimock was comprehensive and included, through May 2012, sampling at 64 homes and analysis for approximately 225 analytes (parameters) per sample. Furthermore, multiple samples were collected at each home to assess the water quality at the well, at the tap, and, where applicable, before and after any existing home water treatment system. In addition, quality control samples were collected as recommended by EPA's Quality System. Overall, the Agency collected and analyzed approximately 300 discrete samples, yielding over 67,000 individual analytical results.

Following laboratory analysis, results were validated for completeness by both an internal peer review process and a third party. In some instances, results were qualified to indicate the overall quality and acceptability in using those results. When analyzing samples, quality control checks are routinely completed at the various review levels to confirm the precision and accuracy of the result. When acceptance criteria are not met, results are qualified. More details on the criteria and review process are provided in the *Dimock Residential Ground Water Site Technical Summary of the Data Collection, Validation and Review Process* (Technical Summary) and associated referenced documents.

After releasing results to the initial set of residents, several items were raised by citizens during home visits, by the EPA site team and others which led to some process improvements. Those items related to consistency of the data qualifiers applied to analytical results during the review process and some modifications to analytical methods during the first round sampling event. Discussion of these and other issues are included in the Technical Summary.

Dimock Residential Ground Water Site
Technical Summary of the Data Collection, Validation and Review Process
July 24, 2012

Sampling/Data Use Objectives

The objective of sampling was to determine whether any toxic substances were present in the residential drinking water wells at this site that may pose a threat to the health of persons ingesting, contacting or engaging in typical residential uses of the groundwater to the extent that an EPA Removal Action should be continued, expanded or terminated. The analytical protocols were selected based in part on contaminants that may be present due to natural gas exploration, drilling or hydraulic fracturing activities occurring in the region. The project sampling and analytical approach is included in the *Residential Well Sampling QA/QC Work Plan Dimock Residential Groundwater Site* Rev 01 February 29, 2012 (Sampling QA/QC Work Plan).

Following collection, the water samples were shipped to various laboratories for analysis. Samples were analyzed by EPA laboratories, as well as independent subcontracted labs, for over 200 parameters, including organic compounds, inorganic water quality parameters, metals, radionuclides, and bacteria. A complete list of parameters, and the associated methods utilized by the labs and the QA/QC procedures followed throughout the sampling event, including chain of custody, are identified in the Sampling QA/QC Work Plan.

Data Review

The EPA Quality System requires that all data produced must be of known and documented quality based on sound scientific principles using specific data review protocols. These established data review protocols were used for assessing and documenting the quality of data generated for this project. This review process is consistent with the criteria established in the *Guidance for Environmental Data Verification and Data Validation (EPA/G-8)*, November 2002, EPA/240/R-02/004.

Described in this Technical Summary is the systematic data review process followed for this project. Also included is a summary explaining data review decisions that were implemented to address project-specific data quality issues.

Project Data Review Process

Before data are used for decision making all steps of the data review process must be completed. This data review process consists of data verification and validation to evaluate whether data were generated according to the established procedures and met performance criteria (QC criteria). The terms "verified", "validated", and "final" were specifically defined for this project and are included in the matrix to delineate the different stages of reports through the data review process.

Verified: data peer-reviewed by lab personnel

Validated: data that has undergone both data verification and a review for compliance with project objectives.

Final: data, and associated reports, that have undergone data verification, validation and data usability assessment (project-level review).

Data Review Process

Step	Description	Action	Data Status
1	Lab Reports	Each laboratory submitted verified data to Region 3	Verified
2	Data Validation	EPA laboratory reports were reviewed for completeness and compliance to the project objectives. EPA, with assistance from the Environmental Services Assistance Team (ESAT) contractor, validated the commercial laboratory's data packages. Upon completion, reviewed reports were posted to EPA FTP site.	Validated
3	Data uploaded to the SCRIBE database	Validated data obtained from EPA FTP site was uploaded to the SCRIBE database	Validated
4	Data Usability Assessment (Project Level QA/QC Review)	EPA, with assistance from the Environmental Response Team's (ERT) Scientific, Engineering, Response, & Analytical Services (SERAS) contractor, performed the Project Level QA/QC on all results from all labs. Modifications to flags, if appropriate, were made in SCRIBE.[1]	Validated
5	EPA Site Data Team Final Review	EPA Site Data Review Team performed a final review of the data to determine whether it can be used for decision making.	Final
6	EPA Toxicologist Review	The EPA Toxicologist reviewed the final data and made health-based recommendations to the On-Scene Coordinator. Final data was also provided to EPA Headquarters for review by technical staff.	Final
7	Internal Reporting	A data summary table was prepared (coded to protect privacy) for each home sampled.	Final
8	External Reporting	A transmittal letter of the results was prepared and sent the homeowners. All homeowners were afforded an opportunity to meet with EPA to discuss their data results. Where there were exceedances, a representative from the Agency for Toxic Substances and Disease Registry (ATSDR) attended the home visit.	Final

[1] Flags (ie. qualifier codes) are used to indicate potential impacts to data quality that could affect data usability. Flags are applied by the laboratory during data verification and reviewed during data validation. During project-level review, flags may be added or modified depending on the overall project requirements.

Data Validation

Analytical data were reviewed according to each laboratory's respective documented quality system, which included a data verification (completeness) check. Data validation (compliance, recalculations, and instrument output evaluations) was performed according to the EPA *Region III Modifications to National Functional Guidelines for Organic Data Review Multi-Media, Multi-Concentration (OLMO1.0-OLMO1.9)* (September 1994) and *National Functional Guidelines for Superfund Organic Methods Data Review* (June 2008), EPA-540-R-08-01. Inorganic data were validated according to *EPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (April 1993) and *National Functional Guidelines for Inorganic Superfund Data Review* (January 2010), EPA 540-R-10-011. For microbiological and radiological data, the validation was performed according to *Guidance for Environmental Data Verification and Data Validation (EPA/G-8)*, November 2002, EPA/240/R-02/004, and method specific criteria.

In instances where quality control criteria were not met according to the above procedures, flags (ie. qualifier codes) were applied to laboratory results. A key of the codes were provided to the homeowners in the final reports.

Data Usability Assessment (Project Level QA/QC Review)

To assess whether data could be used for the intended purpose of this project, a data usability assessment was completed on all validated results (Project Level QA/QC Review).

The purpose of the data usability assessment was to determine whether the performance and acceptance criteria developed in the planning process were achieved. Qualifier codes (flags) were modified, added, or deleted, as appropriate, to document the quality and usability of the data. The data usability assessment process is described in detail in the attached *SERAS Validation Procedures*.

A final determination of usability was made by the EPA Site Data Review Team.

All results were electronically submitted by the laboratories to EPA's databases (e.g. SCRIBE). Qualifier codes were modified in the database according to data validation and/or data usability assessment procedures cited above. Final reports were then generated directly from SCRIBE.

All final reports were reviewed by EPA risk assessors to evaluate the data results for each home for any health-based recommendations. The final reports were reviewed concurrently by a peer group of EPA Headquarters technical staff to provide an additional level of scientific certainty to the process.

Summary of Specific Concerns Regarding Data

- Data Validation Result Qualifier: Rejected Data

During the data verification and/or data validation process, data may be rejected if there is a significant problem during analysis or significant quality control issue. For this project, rejected data were qualified with an "R" in the data packages provided to citizens. The Key included with the data packages provided a brief explanation of why data were rejected. Additional detail regarding why the specific data were rejected is included below.

1) Diethylene and Triethylene Glycol Analyses – Glycol analysis was conducted using two analytical techniques on different analytical instruments (GC/FID and LC/MS/MS). When analyzing by GC/FID, the detected analyte must be confirmed by using a second column or by analyzing with a mass spectrometer as per the specified method. Certain diethylene and

triethylene glycol GC/FID data were rejected because the analyte was detected above the Method Detection Limit (MDL)[2] and less than the laboratory quantitation limit (QL), but was not confirmed by the laboratory per the specified method. Glycol analysis was also conducted using the LC/MS/MS technique which provides a lower QL than the GC/FID method. Diethylene and triethylene glycol were not detected above the QL using the LC/MS/MS method. Therefore, the rejection of the GC/FID results did not cause any significant loss of information by which EPA made decisions since the second analytical procedure used (LC/MS/MS), did provide data of known quality consistent with project objectives.

2) Heterotrophic Plate Count Analysis - Heterotrophic Plate Count (HPC) is a microbiological method used to measure the abundance of heterotrophic bacteria in a water sample. Heterotrophic bacteria include all bacteria that consume organic compounds. Although the HPC includes a variety of bacteria, it does not include all bacteria in a water sample. A lower concentration of HPC bacteria would indicate that the water system is better maintained. For HPC analysis, certain data were rejected because quality control procedures were not properly followed. More specifically, data were rejected because the lab did not run a method blank (i.e. sterility control) for each series of samples plated, which determines whether the test samples could have been contaminated during analysis.

Although certain HPC data were rejected, the water samples were also analyzed for the presence of Total Coliform Bacteria. While the presence of coliform bacteria does not directly indicate a potential health threat, it is used to indicate whether other potentially harmful bacteria may be present. If the results indicated the presence of coliform bacteria, the samples were further analyzed for the presence of Fecal Coliform Bacteria, whose presence would indicate that the water may be contaminated with human or animal wastes.

EPA does not typically sample for bacteriological contamination or take an action solely on the presence of bacterial contamination. Samples were taken and analyzed for bacteria at this site so that information would be available should EPA need to provide a water treatment system due to the presence of a contaminant(s) for which EPA has the authority to act.

Although some information was lost due to the rejection of certain HPC data, EPA could always re-sample, as needed, should an EPA action for water treatment be proposed. In addition, judgments on the severity of bacterial contamination can be made with the remaining data.

3) Semi-Volatile Organic Compound (SVOC) Analysis - For SVOC analysis, some non-detected data were rejected due to low recoveries of required method quality control checks. Specifically, the laboratory added known amounts of other chemicals (surrogates) or known amounts of target compounds (blank spike) to samples to assess recovery of similar compounds during sample preparation (extraction) and analysis. If the results for the surrogates or spiked compounds were found to be outside the acceptable range stated for the method, then the results were rejected. Although some of the individual SVOC results were rejected, the availability of duplicate samples permitted EPA to make decisions using data of good quality. Therefore, the

[2] The MDL is the minimum concentration of a substance that can be measured and reported with 99-percent confidence that the concentration of the substance is greater than zero. The QL is the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions, typically set at the lowest standard in the calibration curve.

rejection of some SVOC results did not cause any significant loss of information by which EPA made decisions.

- Data Validation Result Qualifier: Differences in Quantitation Limits (QLs)

Based on concerns raised during some initial home visits, it was determined that there was a need to provide additional information regarding the QLs in subsequent data packages. More specifically, questions were raised on why there were differences in QLs for results for the same analyte at different home sampling locations. As noted in the Key included with the data packages, "U" indicates that the analyte was not detected. If there was a number next to the "U", that number (QL) is the amount of analyte that would have to be present to be detected by the lab given the particular method and/or instrumentation. Although QLs should generally be consistent from sample to sample using the same methodology there are legitimate analytical situations where the QL may differ. Information regarding the cause of the different QLs is noted below:

1) The different QLs may reflect the differences in the volume of sample used for the extraction process in the lab. For example, a typical sample volume for SVOC extraction is 1000 mL; however, sometimes the sample volume collected is less than 1000 mL. The exact volume used is then included in the calculation in determining the QL for that sample. Therefore, a QL can be reported at 4.76 ug/L instead of the typical QL of 5.00 ug/L.

2) Contamination in a blank may result in the QL being raised. When a target compound is present in a blank[3] (i.e. method blank, field blank, trip blank) the laboratory will qualify the sample result(s) with a "B" when the value measured is at least 5 times (potentially up to 10 times for common laboratory contaminants) the blank value. In accordance with the National Functional Guidelines (referenced below) the procedures for blank contamination require the QL to be elevated (to the level of the highest associated blank), and qualified "U" as non-detect.

3) The QL may be raised when the Quality Control criteria are not met. For example, when a low-spike quality control (QC) sample has a recovery of zero percent for a particular compound, the QL is raised to the level of the next QC sample (mid-level spike QC sample).

- Data Validation Result Qualifier: Inconsistent Use of a Definition for "UJ"

Qualifier codes are used to indicate potential impacts to data quality. The "UJ" qualifier is used when an analyte was not detected above the established quantitation limit. A qualifier code key was provided to each homeowner with the final results. This key included a definition of the "UJ" qualifier quoted from an existing EPA fact sheet developed to assist the public with interpreting lab results. For the "UJ" qualifier code the key included the following language:

"The U before the J means that the analyte was not detected in the sample, but this result may be inaccurate. Some analyte may be present."

After using this definition in the key, it was discovered that this definition is not consistent with the official Agency guidance, *National Functional Guidelines for Superfund Organic Methods Data Review*

[3] Certain QC samples, including samples referred to as blanks, are collected to check for possible cross-contamination or error in the field and/or laboratory. Field blanks (including trip blanks and equipment blanks) are collected to check for possible cross-contamination during sample collection, and shipment, as well as in the laboratory. Field blanks also check for possible contamination associated with the sample containers and preservatives. Laboratory blanks (also referred to as method blanks) are used throughout the entire analytical procedure to check for possible contamination at the laboratory.

(June 2008), EPA-540-R-08-01 and *National Functional Guidelines for Inorganic Superfund Data Review* (January 2010), EPA 540-R-10-011, which defines UJ as noted below:

> For non-Contract Laboratory Program (non-CLP) organic data, "UJ" is defined as follows: The analyte was not detected at a level greater than or equal to the adjusted reporting level (RL). However, the reported adjusted RL is approximate and may be inaccurate or imprecise.
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> For non-CLP inorganic data, "UJ" is defined as follows: The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

Per EPA's guidance, the 'U' qualifier indicates that the analyte was not detected at or above the quantitation limit reported (e.g., 10 U, where 10 is the quantitation limit). The 'J' qualifier indicates that the analyte was qualitatively detected and the reported value is estimated. The 'UJ' combines these definitions and indicates that the analyte was not detected above the reported quantitation limit, although that limit is approximate.

- Changes in Parameters, Methods and Labs throughout the Sampling Event.

  Establishing sampling protocols, selecting analytical parameters and methods, and determining laboratory assignments were all part of the initial planning for this site. Initial sampling activities began on January 23, 2012 in accordance with the January 9, 2012 *Residential Well Sampling QA/QC Work Plan Dimock Residential Groundwater Site* (Sampling QA/QC Work Plan) with updated tables dated January 20, 2012. Any changes in the selected parameter lists, methods, or laboratory assignments were reflected in subsequent Sampling QA/QC Work Plan revisions.

  The Sampling QA/QC Work Plan was revised on February 28, 2012 (Rev 01) to reflect changes in field sampling procedures. Specifically, the revised plan included a provision for simultaneous sampling at the wellhead and at the tap to allow for a shorter purge time, if conditions were warranted, and allowed for sample collection through brass adapters when there were space limitations. In addition, only one sample per residence was collected for radiological analysis. This change, based on prior sampling at the site, allowed for a more efficient use of sampling resources with no change in individual sample quality.

  Laboratory assignments for glycol analysis were changed starting with the March sampling since an EPA laboratory was available to analyze for ethylene glycol, which was previously contracted to a commercially available laboratory. Since glycols were not detected in any of the prior samples, even at low levels by LC/MS/MS, the full suite of glycols by GC/FID was determined not to be needed for subsequent samples; therefore, use of a contracted commercial laboratory was discontinued.

  The revised Sampling QA/QC Work Plan dated March 2, 2013 (Rev 02) addressed the elimination of some methods starting with the March sampling. These methods were eliminated due to the absence of any of the associated parameters in the first set of samples. This change was taken to add efficiencies based on lessons learned.

The Sampling QA/QC Work Plan was again revised on May 17, 2012 to support the Supplemental Round 1 sampling of three residences not included in the initial sampling effort.